TECHNOLOGY EVALUATION
FIELD TEST PLAN

FOR

KATEC AEROSOLV®
Aerosol Can
Puncturing & Draining Technology

July 28, 1998

Katec Aerosolv® Technology Field Test Plan

PROJECT MANAGEMENT
TITLE AND APPROVAL SHEET

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FIELD TEST PLAN FOR KATEC AEROSOLV® TECHNOLOGY

INTRODUCTION

Katec, Inc. has applied to the joint U.S. EPA and Cal/EPA Environmental Technologies Verification Program (ETV) for federal verification and state certification of its Aerosolv® aerosol can puncturing and draining technology. The Aerosolv® technology consists of an aerosol can puncturing/draining device that mounts to the top of a 55-gallon or smaller drum for containing the liquid fraction of the contents along with a carbon filter (30-gallon drum) for capturing the non-condensable gases and volatile fractions. This plan presents the details of the field testing activities which will be conducted at the U.S. Navy Public Works facility in National City (San Diego, California) which are necessary to evaluate this technology for verification/certification.

PURPOSE

The purpose of this test plan is to evaluate the performance of the Aerosolv® aerosol can puncturing and draining technology in terms of the requirements set forth in Section 25201.14 (a)(1) of the California Health & Safety Code (H&SC). Section 25201.14 (a)(1) H&SC allows facilities to operate aerosol can puncturing and draining technologies under *Conditional Exemption* from hazardous waste treatment permit requirements if DTSC has certified that the technology is designed to (1) capture the gaseous and liquid contents of the cans, (2) prevent fire, explosion, and unauthorized releases of hazardous constituents, and (3) prevent worker exposure to hazardous materials released from the cans. This statute further requires that the emptied aerosol containers from conditionally exempt aerosol can puncturing and draining technologies be recycled as scrap metal after treatment.

One objective of this work plan is to quantify the extent of capture of the liquid and gaseous contents of the waste aerosol products treated. This evaluation is necessary to assess whether the system has been reasonably designed to prevent significant releases of contaminants. It should be noted that performance standards for the capture of the contents of aerosol cans by puncturing and draining technologies have not been established, and that it is not the intent of this certification evaluation to establish such a standard.

Katec, Inc., has requested that their technology be evaluated in terms of its ability to treat aerosol cans such that the residual remaining after treatment is less than 3% of the original can contents, the federal definition of an empty container. Therefore, another objective of the testing is to evaluate the capability of the Aerosolv® technology to achieve the 3% federal criterion for an empty container. A related objective is to determine of the removal efficiency of the system, or the fraction of the untreated can contents that is removed by the technology. No standard for removal efficiency currently exists.

Importantly, the Field Test Plan will also evaluate the adequacy of the Aerosolv® technology to protect worker health and safety and to prevent fire and explosion hazards as required under Section 25201.14 H&SC for certification of the technology. Field testing will evaluate under anticipated operating conditions, whether emissions concentrations within the operating zone of the unit are likely to remain below the allowable daily exposure, D, as defined in §5155 Title 8 CCR , as well as below other applicable concentration limits for protection of worker health and safety set forth by CAL OSHA, OSHA, and NIOSH.

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FIELD TEST PLAN OBJECTIVES

Removal

1a. **Removal to 3% of Capacity.** For each aerosol can product evaluated, determine the ability of the Aerosolv® technology to treat aerosol cans to less than 3.0% of the original can contents or capacity, the federal definition of an empty container. Establish whether the mean fraction of the original can contents remaining in the can after treatment is 3.0% or less with 90% confidence.

1b. **Removal Efficiency**. *Removal efficiency* is the percent of the contents of the untreated waste aerosol cans that is removed from the cans by the Aerosolv technology. For each class of aerosol product to be evaluated, determine the 90% confidence limit of the mean *removal efficiency*.

System Capture Efficiency

2. S*ystem capture efficiency is* the percent of the gaseous and liquid contents removed from the untreated aerosol cans that is captured by the Aerosolv system. For each aerosol can product tested, measure the system capture efficiency to within +/- 1%. Establish whether the mean capture efficiency is 90% or greater with a confidence of 90%.

Carbon Filter Effectiveness

3a. Determine the total mass of the contents of waste aerosol cans processed by the Aerosolv® treatment technology (mass loading) resulting in carbon filter breakthrough emissions up through the carbon filter changeout criteria established for the field tests.

3b. Measure the total organic vapor concentrations in carbon filter breakthrough emissions to assess their risk to worker health and safety, and to serve as the basis for establishing appropriate criteria for replacement of the carbon filter during operation of the technology, consistent with the 90% system capture efficiency (Objective 2).

3c. Assess the adequacy of the established Standard Operating Procedures (SOPs) in determining when the carbon filter is spent and needs replacement.

Assess Worker Health & Safety in Operating Katec Aerosolv® Technology

4a. Determine the capability of the Aerosolv® technology to operate such that the concentrations of the vapor/gaseous emissions within the operator's breathing zone do not exceed the Cal OSHA- or federal-OSHA Permissible Exposure Limits (PELs) or allowable daily exposure, D, for constituents of concern present in each class of aerosol can to be evaluated for certification. Where PELs are unavailable for certain constituents, recommended Time-Weighted Averages (TWAs) established by NIOSH or ACGIH would be applied. ALARA (as low as reasonably achievable) concentration limits would apply if a PEL or TWA is unavailable for a constituent.

4b. Determine the capability of the Aerosolv® technology to operate such that the concentrations of the vapor/gaseous emissions within the operator's breathing zone do not exceed other regulatory limits including the STEL, IDLH and Ceiling Limits, established by Cal OSHA, federal OSHA, or

NIOSH for worker exposure.

4c. Determine the potential for emissions from operation of the Aerosolv® technology to exceed 10% of the LEL.

4d. Determine the effectiveness of the technology in preventing releases of the liquid contents of the aerosol cans.

FIELD TEST DESIGN

Prior to the test runs the Aerosolv system will be operated for a minimum break-in period of one day or 500 aerosol paint cans. Seven separate test runs will be conducted. Each run will treat a statistically significant number of aerosol cans to evaluate performance. A straightforward approach using gravimetric methods are specified for achieving removal and system capture efficiency objectives. Worker exposure monitoring methods and appropriate air sampling and analytical techniques are also specified in order to achieve objectives for evaluating carbon filter effectiveness and work health and safety.

Removal

Removal to 3% of Capacity (Objective 1a)

The ability of the Aerosolv system to empty the cans such that they meet the federal 3% residual criterion will be evaluated for three aerosol can products. For each aerosol can product class 75 cans will be randomly selected from the inventory available for treatment. During a selected test run for each of three aerosol can classes, these 75 cans will be weighed before and after treatment in the same manner as all cans being treated during the test run. Additionally the tare weight of these cans will be determined after treatment by opening, rinsing, drying and then weighing these cans. The U.S. Navy shall be responsible for measuring aerosol can tare weights in accordance with the procedure described in ENVIRDEPT SOP #:931-98-009. The adequacy of this new procedure will be verified in the field, and modified if necessary. Any modifications to this procedure will be noted and recorded. Pre-treatment, post treatment and tare weights of all cans will be measured using a laboratory balance with a precision of 0.01 gram and accurate to within +/- 0.01 gram throughout the range of measurements to be made. These measurements will then be used to calculate the percent of the original can contents or capacity remaining in each of the 75 treated aerosol cans as follows:

$$\frac{\text{[Wt. , Treated Waste Aerosol Can Contents]}}{\text{[Net Wt., Unused Aerosol Can Contents]}} \times 100\%$$

where, Wt. , Treated Waste Aerosol Can Contents = (Wt., Treated Waste Aerosol Can) - (Aerosol Can Tare Wt.)

and Net Wt., Unused Aerosol Can Contents = " nominal" weight, the net content weight shown on aerosol can label

The mean value for percent of original contents remaining for the 75 treated aerosol cans and the 90% confidence interval around the mean will be calculated for each of the three product categories. The upper limit of the confidence interval for each product category will be compared to the 3.0% criterion using a *t-test*. If the upper confidence interval around the mean is less than or equal to 3.0% criterion, the

system will be deemed as meeting this objective for the particular product category. The *t-test* requires that the data be normally distributed. If the data turn out not to be normally distributed, an alternative statistical test would be considered.

The nominal weight of the can contents or net weight of contents is used in lieu of actual measurements. The reason for this is twofold. First, because the untreated aerosol can is partially full, the measurement of the original or unused aerosol can net contents is not possible. Secondly, a variation in the original net content weights (e.g. +/- 5 grams) would not significantly effect the result (i.e., <0.05%).

Removal Efficiency (Objective 1b)

Data for each aerosol can product class obtained from the treatment of the 75 aerosol cans to address objective 1a will be used to determine the efficiency of the Aerosolv system in removing the contents of the untreated waste aerosol cans. For each of the three aerosol can product classes, removal efficiency for each of the 75 treated aerosol cans will be calculated as follows:

$$\text{Removal Efficiency} = \frac{[\text{Wt. , Untreated Waste Aerosol Can Contents}] - [\text{Wt., Treated Waste Aerosol Can Contents}]}{[\text{Wt. , Untreated Waste Aerosol Can Contents}]} \times 100\%$$

where, Wt. Untreated Waste Aerosol Can Contents = (Wt. Untreated Waste Aerosol Can) - (Aerosol Can Tare Wt.)
and, Wt. Treated Waste Aerosol Can Contents = (Wt. Treated Waste Aerosol Can) - (Aerosol Can Tare Wt.)

As a performance indicator, the mean and the lower 90% confidence limit of the mean for the 75 calculated removal efficiencies will be determined for each of the three aerosol can classes.

System Capture Efficiency (Objective 2)

To determine system capture efficiency the combined weights of the Katec system components will be weighed before and after each test run. A 200 kilogram-capacity drum scale, accurate to within +/- 0.1 kilogram, will be used for this purpose. The difference in weights before and after each test run will be assumed to have been captured can contents. Separate test runs will be used to evaluate capture efficiency for each of the three aerosol can products. Each of the aerosol cans treated during each of the test runs will be weighed before and after treatment to the nearest 0.01 gram using a laboratory balance accurate to within +/- 0.01 gram. Capture efficiency for each test run will calculated as follows:

$$\text{System Capture Efficiency} = \frac{[\text{Wt., Katec System After Test Run}] - [\text{Wt., Katec System Before Test Run}]}{[\text{Wt., Sum of All Aerosol Can Contents Removed by Treatment}]} \times 100\%$$

where, Wt., Katec System = [Wt., Aerosolv Unit] + [Wt., liquid Collection Drum] +
[Wt., Coalescing Filter & Vapor Transfer Line] +
[Wt. of Carbon Filter and Indicator (if used)];

Wt., Sum of All Aerosol Can Contents Removed by Treatment =

[Sum of Can Weights Before Treatment] - [Sum of Can Weights After Treatment]

To determine system capture efficiency to the desired accuracy, approximately 44 pounds (20

kilograms) will have to be collected by the treatment system for each test run. Because the certification will be limited to cans less than one-quarter full to reduce the potential for uncontrolled releases/emissions, a relatively large number of aerosol cans will required for each test run. Due to the variability in the fullness of the cans available for treatment, it is not possible to know in advance the actual number of cans required to be treated during a test run. The number of cans required for determining the capture efficiency may be reduced by increasing the fullness of the waste aerosol cans to be treated for the test runs.

The mean of the capture efficiencies for the test runs and an associated confidence interval will be computed for each aerosol can product. The Aerosolv system will be deemed to have met the capture efficiency objective for the particular aerosol can product class, if the lower 90% confidence limit around the mean capture efficiency is equal to or greater than 90%. Due to resource limitations, only two or three test runs will be used to determine capture efficiency for each aerosol can product. A narrow confidence interval around the mean value is unlikely. Because there is no regulatory standard for capture efficiency, the 90% objective is not viewed as a rigid pass/fail criterion requiring high data quality.

Carbon Filter Effectiveness (Objective 3)

A fresh, unused carbon filter will be installed prior to the pre-test run and before the start of the initial test run for each of the three aerosol can products to be evaluated (Test Runs #1, #4, and #6). During each test run the outlet of the carbon filter (between the carbon filter and the colorimetric indicator) will be continuously monitored using an organic vapor analyzer with a flame ionization detector (FID). The carbon filter will be required to be replaced during the test runs when the carbon filter outlet concentration either:

- Exceeds 10% of the total organic vapor concentration at the carbon filter inlet; or.

- Results in a concentrations level specified in the Health and Safety Plan that requires ceasing test operations.

The certification condition proposed for requiring replacement of the carbon filter is when total organic vapor concentrations in emissions from the carbon filter reach 10% of the total organic vapor concentration at the carbon filter inlet. Results of the field testing will be reviewed to ensure that this proposed condition is appropriate, that carbon filter emissions concentrations of toxic air contaminants present in the aerosol can products do not have the potential to exceed worker health and safety requirements or applicable statewide toxic air emission requirements.

Carbon capacity will be evaluated by determining the number of cans processed and the cumulative weight of their contents corresponding to increasing breakthrough concentrations until the carbon is changed out (Objective 3a).

An OVA with an FID (flame ionization detector) will be used to continuously measure concentrations of total organic hydrocarbons in the emissions from the carbon filter. Once a five (5) second time-weighted average concentration of 100 ppm total organic vapors is exceeded in the carbon filter exhaust emissions, an OVA/FID will be used to measure concentrations of total organic hydrocarbons in the inlet to the carbon filter. These measurements will be made during a period of not

less than one minute, while puncturing and draining a minimum of three (3) waste aerosol cans. Once initiated during a test run, carbon inlet measurements will be taken every 250 cans. Carbon filter changeout will be necessary when the five (5) second time-weighted average concentration of the total organic hydrocarbon concentrations measured in the carbon filter exhaust emissions reach 10% of the total organic hydrocarbon concentration measured in the inlet to the carbon filter.

A five (5) second time-weighted average was selected to correspond to the duration of gas flow through the filter while puncturing of a single partially-full waste aerosol can. If this estimated gas flow time interval is found to be different during the field tests, then this time interval and associated time-weighted average criterion will be modified to reflect actual operating conditions.

The FID direct reading operating range is limited to below the upper explosive limit or UEL of the mixture of organic vapors/gases sampled. The linear operating range of a Foxboro TVA-1000 OVA with the FID is up to 10,000 ppm for methane with an accuracy of +/-25% of the reading (The dynamic range is up to 50,000 ppm for methane). To measure the higher concentrations that are expected in the exhaust emissions and in the carbon filter inlet, a dilution sampling port supplied by the manufacturer is required. Once the linear operating range of the instrument is exceeded during a test run at either sampling location, an appropriate dilution sampling port (10-fold, 25-fold, 50-fold or 100-fold dilution) should be calibrated and installed for use with the OVA monitor.

Data from the continuous monitoring of the carbon filter exhaust will be used to assess the adequacy of established or proposed standard operating procedures for routine monitoring and replacement of the carbon filter. (Objective 3c)

Worker Health & Safety (Objective 4)

Preliminary field observations and review of the design of the Aerosolv® puncturing and draining system indicate that the design of the technology may not prevent accidental releases caused by operator error. This is particularly a concern when treating waste aerosol cans that are significantly full of product. If an operator withdraws the puncture pin of the Aerosolv® unit from the aerosol can too quickly, visible amounts of liquid product as well as gaseous contents may be released past the puncture pin's O-rings or past the can shoulder gasket. The applicant has requested to limit certification to less than one-quarter full cans to reduce the potential for uncontrolled liquid or gaseous releases. A related concern is the compatibility of the Viton™ O-rings with ketones present in paint products. Leaks due to degradation of these seals over time due to exposure to ketones potentially could occur.

The wide variety of compounds or mixtures with low PELs (permissible exposure limits) that may be present in aerosol cans also presents a concern. The test plan assumes that exceedances may occur and that certification will be conditioned on having specified engineering controls in-place. Use of APRs would only be required where the use of engineering controls are impractical or ineffective. Because the use of air purifying respirators (APRs) may not be appropriate in preventing worker exposure to all can aerosol constituents that may be encountered, use of APRs would be restricted to situations where the chemicals of concern were known, the cartridge breakthrough times and warning properties were adequate, filter cartridges for these chemicals were available, the APR were fit-tested to the operator, and the Assigned Protection Factor (APF) were 10 or greater.

For the purpose of testing the Aerosolv® technology, the use of APRs by personnel participating in the testing shall be in accordance with the Navy's Respiratory Protection Plan, as referenced in the

Health and Safety Plan for the field testing, and shall include medical monitoring and testing.

The Health and Safety Plan for the field tests requires the U.S. Navy to perform personnel monitoring with personal sampling pumps and sorption media during the test runs and to analyze samples using OSHA Method 07 at the U.S. Navy's AIHA-certified laboratory on base. The personal monitoring will include the determination of short term exposures over the full shift along with area sampling. Personnel monitoring is required to assess operator exposure and will provide quantitative data on the worker's breathing zone exposure for the specific conditions encountered during the test runs. Field testing will be conducted to characterize potential exposure for an envelope of conditions under which the technology might be operated. If the data show that operation of the technology results in a potential for exceeding Cal OSHA, OSHA or NIOSH criteria for worker protection, then a condition of certification would be to require appropriate engineering controls, and if necessary air purifying or air supplied respiratory protection for operators.

Constituents of interest found in each of the aerosol can classes and their corresponding Cal OSHA**,** OSHA and NIOSH criteria for protection of worker health and safety are presented in Table 2. Some constituents with low toxicities may be considered as surrogates for other more toxic compounds with similar physical properties. Not all constituents shown in Table 2 will be present in the specific products to be tested. A number of compounds having moderate to high volatilities and low PELs are present in significant amounts in aerosol can products. For example, toluene represents 25% to 30% of the total contents of some products (OSHA PEL=200ppm; Vacated PEL=100; Cal OSHA PEL=25 ppm, NIOSH TWA=100; OSHA IDLH=500), while tetrachloroethene constitutes 95% of others (OSHA PEL=100ppm; Vacated PEL=25ppm; Cal OSHA PEL = 50 ppm, NIOSH TWA=ALARA (carcinogen); OSHA IDLH=CA; 150ppm).

Continuous monitoring and recording organic vapor analyzers with a flame ionization detector (FID) will be used to qualitatively assess emissions during operation of the Aerosolv® technology that may pose a risk to worker health and safety. Using the FID data, concentrations of specific constituents will be estimated based on the suite of ingredients contained in the aerosol can product and their relative fractions. As a conservative assumption, the relative concentrations of chemical constituents in the emissions near the puncturing device during the puncture of a can are assumed to be the same as the relative concentrations of the ingredients in the can because a rapidly depressurized can is assumed to emit an aerosol similar in composition to that obtained from depressing the nozzle while using the product. In addition, the volatile constituents in the aerosol are assumed to evaporate rapidly, resulting in airborne concentrations proportional to the amount of each volatile constituent originally in the can.

The primary sources of emissions that may present a hazard to worker health and safety are assumed to be the puncturing and draining unit (Aerosolv® unit) itself and the indicator cartridge exhaust vent. Therefore, in addition to the fixed OVA used to monitor the carbon filter outlet (objective 4), a dedicated OVA will be fixed in position to monitor the breathing zone concentration near the Aerosolv unit. This position is tentatively identified as immediately downwind from the Aerosolv® unit at a height of 5 feet above the ground mounted at a point within a 24 inch radius of the operator's mouth and nose, as close as possible to the Aerosolv puncturing unit. This is intended to account for the possibility that due to shifting wind direction or equipment location constraints that the operator is positioned downwind of the Aerosolv puncturing device.

Additionally, the fixed OVA used to monitor the carbon filter exhaust will be periodically used for

background measurements, general system leak detection and also to assess whether the fixed organic vapor analyzer is positioned at the correct height or in downwind direction to obtain maximum readings.

Even a small wind velocity can have a dramatic effect in diluting measured emissions concentrations. Therefore, it is important that test runs be conducted when wind speeds do not exceed 0.5 mph. Consequently, an anemometer will be used to measure wind speed and direction. Depending on the micro-climatic conditions during the period when the test runs are to be conducted, the test runs may have to be conducted in a wind-protected area. Alternatively, if it is not possible to conduct the field tests in a wind-protected area or to complete the field test outdoors during sufficient periods where wind speeds are below 0.5 mph, then the certification may be conditioned to operating the technology during wind speeds representative of conditions encountered during field testing.

Objectives 4a & 4b

As discussed above, worker exposure monitoring along with continuous downwind monitoring and recording using a total organic vapor analyzer with an FID will be used to estimate the maximum expected breathing zone concentrations resulting from operation of the Aerosolv® technology. Monitoring results will then be compared to the OSHA and Cal OSHA limits on the instantaneous (Ceiling Values), short term- (STEL) and longer-term-average (PEL, allowable daily exposure, D, and REL) concentrations to determine whether there is potential for the Aerosolv system to exceed these limits for the identified constituents of concern. If the chemicals present cannot be quantitatively speciated, the relative amounts of constituents in the emissions during puncture of a can is assumed to be the same as the relative amounts of original ingredients in the can. Any FID monitoring data indicating the presence of concentrations above these limits will be cause for determining that operation of the technology does not prevent worker exposure to hazardous constituents.

Additionally, system capture efficiency data (objective 2) for each class of aerosol can product will be used to determine average mass emission rates for compounds of concern for each of the aerosol can products treated during the test runs. These calculated emission rates will be used to assess whether workplace exposure will below the allowable daily exposure, D, for an outdoor operation.

Objective 4c

In accordance with procedures set forth in the Health and Safety Plan for the field test, a combustible gas indicator (CGI) will be used to assess the potential for emissions from the operation to exceed 10% of the LEL. The CGI will be located in a downwind area no closer than 30 inches to the carbon filter exhaust port.

Objective 4d

Visual observations of any liquid releases for each can tested will be recorded. The fraction of cans treated for which liquid releases occurred will be a semi-quantitative performance indicator. However, obtaining weight measurements of these releases is problematic and beyond the scope of this work plan. Descriptions of the amount and nature of each release will be recorded. These will provide qualitative indicators of safety and effectiveness.

AEROSOL CAN PRODUCTS TO BE TESTED AND EVALUATED FOR CERTIFICATION

The Aerosolv® technology will be evaluated for operation on three general classes of aerosol cans. These classes include (1) Paints, (2) Petroleum Hydrocarbons - lubricants and cleaners, and (3) Halogenated Hydrocarbons - lubricants and cleaners. Therefore, a certification decision based on the results of this Field Test Plan will address the operation of the Aerosolv® technology on only these classes of aerosol can products. Importantly, other classes of aerosol can products including, but not limited to, adhesives, corrosives and pesticides, are **NOT** within the scope of this certification evaluation.

Table 1 lists types of chemicals generally found in each of the three classes of aerosol cans and examples of specific compounds that may be present based on MSDS information provided by the U.S. Navy. The halogenated and non-halogenated lubricants and cleaners appear to contain compounds with a similar range of chemical and physical characteristics. Paints contain similar chemicals along with paint solids.

One set of test runs will treat aerosol paint products. The paint product chosen contains a mixture of aromatic and possibly aliphatic hydrocarbon solvents, medium and low boiling ketones, paint solids, possibly dichloromethane, along with dimethyl ether and/or propane, butane, and isobutane propellants. The paint solids provide a test of the coalescing filter. The dimethyl ether propellant, and the ketones, test the ability of the indicator cartridge to detect compounds expected to be oxidized by potassium permanganate.

A second set of test runs is intended treat a product containing relatively high boiling solvents, tetrachloroethene and Stoddard solvent, and possibly 1,1,1-trichloroethane. These test runs are also intended to evaluate the effectiveness of the saturation indicator cartridge. The propellant is carbon dioxide propellant, which is not expected to be adsorbed much by carbon or detected by the colorimetric indicator. If the products treated during this set of test runs contain significant concentrations oxygenated scavengers and inhibitors, their presence would compromise the results of this set of test runs for evaluating the effectiveness of the indicator cartridge.

A third set of test runs will treat a product containing a relatively high boiling naphtha solvent mixture along with a low boiling 1,1,2-trichloro-1,2,2-trifluoroethane (Freon-113) solvent. This solvent has a boiling point similar to that of dichloromethane. The propellant in this product is chlorodifluoromethane and possibly 1,1,1,2-tetrafluoroethane. These test runs are also intended to evaluate the saturation indicator for false negative readings. Therefore, oxygenated compounds must not be present in products treated during these test runs.

A list of the specific aerosol can products chosen for each set of test runs and their corresponding chemical composition based on U.S. Navy MSDS information is presented in Table 3. If cans with compositions other than those specified are included in the test runs, this may compromise the ability of the test to evaluate the indicator cartridge or worker health & safety.

Source of Aerosol Cans for Testing

The U.S. Navy's Public Works Center will provide from their inventory of waste aerosol cans the requisite number of partially-full aerosol cans to be used in the field tests for evaluating the Aerosolv® technology. Sorting and segregating of waste aerosol cans will be done in accordance with Navy SOP# 931-96-006. In advance of the field tests the U.S. Navy will segregate from their waste inventory and confirm the availability of the necessary number of cans and classes of cans for each of the test runs

identified in this test plan. An MSDS corresponding to the serial number or date of manufacture for each aerosol can product used in the test runs shall be provided to the DTSC which identifies the relative concentration of constituents contained in that aerosol can product.

Waste Stream Characterization - Composite Liquid Samples

Confirmation of the contents of the aerosol can products to be tested is problematic. The initial approach taken was to limit test runs to a few individual aerosol products and perform a GC/MS analysis on the contents of two randomly selected aerosol cans for each product tested. Because of the potentially many different types of paint products to be tested during the paint test runs (two companies, but numerous products/colors, potentially different formulations) this approach would require a large number of cans be tested and was deemed infeasible. The approach now taken is to obtain a minimal number of composite samples of the liquid collected in the liquid collection drum, one when the liquid drum is 35% full and one when the liquid drum has reached capacity (70% full), or at the completion of the set of test runs. These results will provide a semi-quantitative indication of the composite mixture of aerosol can contents treated and ensure that constituents are not present which are not being considered in the evaluation. Of concern, would be a constituent present in significant concentration that was not being analyzed in the personnel or air emission monitoring being conducted to evaluate the technology. Unexpected constituents may also compromise an evaluation of the indicator cartridge. This effort requires approximately 3 composite liquid samples for the set of test runs for paint aerosol can products and 2 composite liquid samples each for the other two sets of test runs: a total of 7 composite liquid samples. Duplicate samples shall be collected with disposable glass thieves and placed into two 40-ml glass VOA vials. DTSC shall provide sampling equipment. U.S. Navy shall be responsible for sample collection. DTSC shall be responsible for transporting samples to the DTSC Hazardous Materials Laboratory for analysis by HML's GC/MS Scan for Volatiles method, which uses the same analysis conditions as Method 8240. This method is qualitative, provides relative concentrations, and will include tentative identification of the ten largest unknown peaks.

TABLE 1

Chemical Constituents Found in Classes of Aerosol Cans Being Evaluated

TYPE #	DESCRIPTION	EXAMPLES	Paints	Petroleum Hydrocarbons - Cleaners & Lubricants	Halogenated Hydrocarbons - Cleaners & Lubricants
1	Gaseous Hydrocarbon Propellants	Propane, isobutane, butane, liquefied petroleum gas	X	X	
2	Inert Gas Propellants	carbon dioxide			X
3	Chlorofluorocarbon Gases	dichlorodifluoromethane, 1,1,1,2-tetrafluoroethane, chlorodifluoroethane, dichlorodifluorethane	X		X
4	Mixed HC VOCs	naphtha, stoddard solvent	X	X	X
5	Specific Aromatic HCs	toluene, xylenes	X		X
6	Low-Volatility HCs	mineral oil		X	X
7	Halogenated VOCs	dichloromethane, tetrachloroethene, 1,1,1-trichloroethane, Freon-113	X		X
8	Ketones	acetone, MEK, MIBK	X		
9	Volatile Alcohols	methanol, sec-butanol, N-butanol	X	X	
10	Alkoxyalcohols	2-butoxyethanol, hexylene glycol	X	X	
11	Volatile Ethers				
12	Polyethers				
13	Other oxygenated cmpds	1-methoxy-2-propanol acetate, N-butyl acetate	X	X	
14	Misc. Organics	Triethanolamine			
15	Polymers & Solids	paint pigments, silicone,	X		X
16	Water			X	
17	Surfactants				
18	Other Propellants	dimethyl ether,	X		X

Table 2, below, identifies constituents of concerns for each of the three classes of aerosol cans along with corresponding criteria for the protection of worker health and safety and monitoring techniques.

TABLE 2

Constituents of Interest For Classes of Aerosol Cans Being Evaluated

AEROSOL CAN CLASS	CONSTITUENT OF INTEREST	OSHA PEL (ppm)	Cal OSHA PEL (ppm)	NIOSH TWA (ppm)	CEILING (ppm)	STEL (ppm)	IDLH (ppm)	LEL / UEL (ppm)	Ionization Potential (meV)	Relative Response Factor PID/FID	PERSONNEL MONITORING METHODS
PAINTS	propane	1000		1000			2100	21000/	11.07	0.26/1.43	combustible gas meter or equivalent
	butane		800	800				16000/	10.63	0.5/1.81	
	isobutane		800	800				16000/	10.57	0.35/1.85	
	dimethyl ether							34000			
	dichloromethane	500	25	ALARA	1000		2300	130000	11.35	0.49/0.78	2 charcoal tubes in series
	toluene	200	25	100	300	150	500	11000	8.82	1.25/2.97	charcoal tube
	xylenes	100	100	100		150	900	11000	≤8.56	1.27/2.93	charcoal tube
	methyl ethyl ketone	200	200	200		300	3000	14000	9.53	0.77/1.89	ambersorb
	2-butoxyethanol	50	25	5			700	11000	10.00		charcoal
	methyl isobutyl ketone	100	50	50		75	500	12000	9.30	0.64/1.84	charcoal
	methyl isoamyl ketone		50						9.28		
	methyl propyl ketone	200	200	150			1500	15000	≤9.53		charcoal
	1,2,4-trimethylbenzene		25	25				9000	8.27		?
	N-butanol	100	50		50		1400	14000	10.04	0.10/1.20	charcoal
	N-Butyl Acetate	150	150	150		200	1700	17000	10.00	0.17/1.56	charcoal
	VM&P Naphtha		300	350mg/m3	1800mg/m3			12000			charcoal (1ppm~3.61-4.74mg/m3)
	Aromatic 150										
	Aromatic 100										
	Light Aromatic Naphtha		100								
	Petroleum Distillates (Naphtha)	500	100	350mg/m3	1800mg/m3		1100	11000			charcoal (1ppm~4.11mg/m3)
	Stoddard Solvent	500	100	350mg/m3	1800mg/m3		20000mg/m3	?			charcoal (1ppm~5.8mg/m3)
HALOGENATED lubricants & cleaners	propane	1000		1000			2100	21000	11.07	0.26/1.43	combustible gas meter or equivalent
	butane		800	800				16000	10.63	0.5/1.81	
	isobutane		800	800				16000	10.57	0.35/1.85	
	Stoddard Solvent	500	100	350mg/m3	1800mg/m3		20000mg/m3	?			charcoal (1ppm~5.8mg/m3)
	tetrachloroethene	100	50	ALARA	200		150		9.32	1.68/1.06	charcoal
	trichloroethene	100	25	ALARA	200		1000	80000	9.45	1.12/0.94	charcoal
	1,1,2-trichloro-1,2,2-trifluoroethane (Freon-113)	1000	1000	1000		1250	2000		11.99	-/1.38	charcoal

AEROSOL CAN CLASS	CONSTITUENT OF INTEREST	OSHA PEL (ppm)	Cal OSHA PEL (ppm)	NIOSH TWA (ppm)	CEILING (ppm)	STEL (ppm)	IDLH (ppm)	LEL / UEL (ppm)	Ionization Potential (meV)	Relative Response Factor PID/FID	PERSONNEL MONITORING METHODS
NON-HALOGENATED lubricants & cleaners	trichlorofluoromethane (Freon-11)	1000	1000	1000			2000		11.77		charcoal
	dichlorodifluoromethane (Freon-12)	1000	1000	1000			15000		11.75	-/0.21	2 charcoal tubes in series
	Liquified Petroleum Gas	1000		1000			2000	20000			combustible gas meter
	Stoddard Solvent	500	100	350mg/m3	1800mg/m3		20000mg/m3	?			charcoal (1ppm~5.8mg/m3)
	Kerosene			100mg/m3				7000			charcoal (1ppm~7mg/m3)
	Naptha										
	2-butoxyethanol		25						10.00		
	4-hydroxy-4-methyl-2-pentanone	50					1800	18000			charcoal
	2-Butanol	150	100	100		150	2000	17000	10.10	0.10/1.20	charcoal
	solvesso		5								
	aromatic petroleum distillate										
	aliphatic petroleum distillate										
	propane	1000		1000			2100	21000	11.07	0.26/1.43	combustible gas meter or equivalent
	isobutane		800	800				16000	10.57	0.35/1.85	

TEST RUNS

This section describes the specific test runs to be conducted to evaluate the Aerosolv® technology for treating the three classes of aerosol cans identified. Table 3, below, identifies the required test runs to be conducted for this field test including the number of aerosol can products to be punctured and drained for each test run.

Pre-Test Runs

The purpose of the pre-test run is to work out unforeseen problems with testing procedures or with established standard operating procedures (SOPs), and to provide a short break-in period for the new equipment to be used. During these runs a variety of waste aerosol paint products will be processed. The type of waste aerosol paint can product, as well as the fullness of can, will be randomly selected from the U.S. Navy's waste storage area. Data collected during these test runs will not be used directly in the quantitative evaluation.

Product Test Runs

Seven (7) test runs are specified in Table 3. Due to the expected variability in results from the treatment of paints, three runs will be used to calculate the system capture efficiency for the aerosol paints. Two test runs are proposed for each of the other two aerosol can products to be tested. If there is significant variance within the capture efficiency results for any aerosol can product tested, then additional testing for that product may be necessary to achieve project objectives.

The time required to treat the specified minimum number of aerosol paint cans listed in Table 3 will depend upon the fullness of the cans selected for treatment. Local APCD requirements limit the number of aerosol cans treated per day to 500. Sufficient mass must be treated within each test run to achieve saturation of the carbon filter and for collecting measurable quantities in the liquid collection drum and carbon filter. Although full or greater than half-full aerosol cans represent the highest risk for leaks/releases of the liquid or gaseous contents of the aerosol cans and would require the fewest cans for determining system capture efficiency, Katec has elected to limit the testing to cans no fuller than 25% of the original net content weight.

Liquid Collection Drum, Carbon Filter, and Colorimetric Indicator Cartridge

An empty liquid collection drum and a new unused carbon filter will be used at the start of the pre-test run and at the start of the testing for each of the three aerosol can products, Test Runs #1, #4, and #6. Additional liquid collection drums and carbon filters will be necessary should they reach their change-out criteria: 70% full for the liquid collection drum, and an effluent concentration equal to 10% of the influent concentration for the carbon filter. Katec will provide a number of colorimetric indicator cartridges equal to the number of available carbon filters. A separate coalescing filter will be used for paint test runs (Test Runs #1, 2, and 3) versus the test runs on the other two aerosol can class products. Spare coalescing filters must be provided for the paint runs in the event that solids buildup and clogging becomes a problem.

Table 3: Test Runs: Aerosol Can Products To Be Tested

Run #	Minimum # of cans (fullness)	Product Name (Manufacturer)	NIIN# Mfg's CAGE Part# Indicator	Aerosol Can Product Class	Constituents
pre-test	500 (variable)	Any paint	n/a	Paints	
1	Number sufficient for cumulative treatment of 44 lbs . (20kg) E.g.: approx 1050 cans (1/16 full)	Eco Sure and SoSure paints containing only the constituents shown in the right hand column (LHB)	to be determined by the Navy	Paints	*product:* xylene methyl isoamyl ketone methyl isobutyl ketone methyl propyl ketone n-butanol Aromatic 100 Aromatic 150 1,2,4 trimethyl benzene *propellant:* dimethyl ether
2	same as run #1	Eco Sure and SoSure paints--same as run #1	same as run #1	same as run #1	same as run #1
3	same as run #1	Eco Sure and SoSure paints--same as run #1	same as run #1	same as run #1	same as run #1
4	same as run #1	Brakleen (CRC Industries)	01167078 10136 A	Halogenated Hydrocarbons - Cleaners & Lubricants	*product:* tetrachloroethene Stoddard solvent *propellant:* carbon dioxide
5	same as run #1	Brakleen (CRC Industries)--same as run #4	same as run #4	same as run #4	same as run #4
6	same as run #1	SoSure Corrosion Preventative Compound (LHB)	009381947 0FTT5 D	Halogenated Hydrocarbons-Cleaners & Lubricants	*products:* aliphatic mineral spirits (naptha)-38% barium sulfate <1% trichlorotrifluoroethane-37% *propellant:* chlorodifluoromethane-16.4%
7	same as run #1	SoSure Corrosion Preventative Compound (LHB)--same as run #6	same as run #6	same as run #6	same as run #6

FIELD TEST ANALYTICAL MEASUREMENTS AND MONITORING REQUIREMENTS

Table 4, below, summarizes the monitoring and analytical methods to be conducted for the field tests. As indicated in the table, certain measurements will be performed in advance of the field tests.

Field Instruments, Equipment and Methods

Laboratory Balance

A Mettler Model PM2000 analytical balance, readable to the nearest 0.01 grams will be used to measure can weights. The balance will be calibrated and logged according to the U.S. Navy SOP LW-BAL Revision 0, 6/11/96, with the following modifications: (1) a calibration check will be performed at the end of each day's operations. Any deviations from the initial daily calibration performed prior to that day's operations (Section 7.0) will be reported along with any corrective actions taken; (2) each calibration will include 0.10, 1.00, 10.00, 100.00, and 500.00 gram weights as well as any additional weights necessary to bracket the can weights (Section 7.6); (3) a linearity of ± 0.01 grams must be demonstrated throughout the calibration range. NIST Class "S" weights shall be used if they can be documented to be equivalent to ASTM Class 1 weights which are accurate to the required 0.01 gram over the range of calibration weights required.

Drum Scale

An Ohaus Champ™ High Capacity Scale, Model E-01006-42, shall be used which has a capacity of 200 kilograms and a readability of 0.1 kilogram. Calibration shall be performed by the San Diego Scale Company at their facility using Class "F" dead weights traceable to NIST, prior to transport to field test site at the Navy Public Works Center facility in San Diego.

Organic Vapor Analyzers

The organic vapor monitors to be used are Foxboro Model TVA-1000 Toxic Vapor Analyzers. The OVAs (FID) will be calibrated using methane span gases after allowing the instruments to warm-up for a minimum of 30 minutes after being turned on. At the end of each day's operation the OVA instruments will be recalibrated to check for any drift that may have occurred. Additionally instruments will be checked periodically (at least every two hours) during the day's operation for base-line drift. Calibrations shall be performed using a "zero" gas which contains 1 ppm total hydrocarbons and a 100 ppm methane calibration gas. Once the linear operating range (0 to 20,000 ppm methane) of the instrument is exceeded during a test run at either sampling location, an appropriate dilution sampling port (10-fold, 25-fold, or 50-fold dilution) supplied by the manufacturer will be calibrated and installed for use with the OVA monitor. **Katec needs to confirm that calibration procedures will also include calibration to calibration gases which span the maximum diluted concentrations that the OVA/FID instrument will be expected to measure at the carbon inlet and carbon exhaust (i.e., two additional calibration gases with methane concentrations around 1000 ppm and 20,000 ppm).**

Composite Liquid Samples from Liquid Collection Drum

For each collection drum, duplicate composite liquid samples will be collected when the drum is approximately 35% full and when the drum is approximately 70% full or at the end of each set of test

runs. Duplicate samples shall be collected with disposable glass thieves and placed into two 40-ml glass VOA vials. Samples shall be analyzed by HML's GC/MS Scan for Volatiles method, which uses the same analysis conditions as Method 8240. This method is qualitative, provides relative concentrations, and will include tentative identification of the ten largest unknown peaks.

Air Velocity and Temperature

An appropriate instrument capable of measuring wind speeds in excess of 0.5 mph and wind direction shall be used during the field testing.

Explosive Gas Monitoring

A Neotronics EXOTEX 40 Portable Multi-Gas Monitor will be used to monitor for explosive atmospheres. For test runs on aerosol paint products with propane propellant the unit will be calibrated to propane following the procedures specified in the EXOTEX 40 instruction manual. Results will be reported in terms of %LEL propane.

Pre-field Test Analyses and Measurements

1. Sort the aerosol cans into the three different classes of aerosol can products that will be used for the test runs and place into labeled, pre-weighed receptacles. Remove any cans containing less than 3% residual contents. Record the tare and gross weight of each receptacle.

2. Confirm contents of aerosol cans. In advance of conducting the field tests, the U.S. Navy will check the contents of selected aerosol cans to verify the expected constituents:

    a. To identify the distribution of different aerosol cans in each product class, randomly select 100 cans from each product class. Sort the cans into groups with identical labels and record the numbers of each type of can and the label information for each type of can.
    b. To identify the range of aerosol cans within each product class authoritatively search the cans to be treated for those with different labels. For each product class, identify as large a variety of product types/part numbers as possible from those to be used in the test.
    c. Review each label on the 100 cans for an ingredients list. If a can contains a complete ingredients list, record the ingredients list, label information, product name and number, and lot/batch number of the can. Sort the cans into groups with the same ingredients.
    d. If a can in a product class does not contain a complete ingredients list, record the label information, product name and number, and lot/batch/production date number of each can. Fax the information for each can to the manufacturer requesting a copy of the MSDS for each can.

3. Label with a unique identification number, weigh and record all unused treatment system components that will be used during the field test runs:

    a. Aerosolv® puncturing and draining device: minimum of 1 for all tests
    b. 55-gallon liquid collection drums, approximately 7 drums
    c. Carbon Filter, at least one per test run and additional ones if needed
    d. Saturation Indicators, 1 for each carbon canister to be used

e. Coalescing filter & vapor Transfer Flex Hose Assembly, minimum of one per product class.

Chain of Custody

a. Carbon Tube Samples - See Site Health and Safety Plan
b. Liquid Collection Drum Samples - standard HML chain-of-custody form will be used

Quality Control Samples

OSHA Method 07 carbon tube samples, worker health and safety personnel monitoring:

QA/QC will be performed in accordance with OSHA Method 07 requirements

Composite Liquid Samples:

a. no QA/QC samples planned -

measurement of product contents at high concentrations to identify relative percentage levels of ingredients; low level of precision required; unlikely any lab contamination of blank or trip blank that would affect results

b. 3 duplicate analyses of liquid collection drum samples required

1 per set of each aerosol can product class test runs
duplicate samples using 40 ml VOA vials will be obtained for this purpose.

TABLE 4 - Summary of Field Test Analytical and Monitoring to Be Performed

Parameter	Frequency	Location	Method	Accuracy/ Precision
Pre- and Post- Field Tests Measurements:				
Weights of each of the following Liquid collection drums Carbon filter drums	Pre-/Post Field Tests	On-site	Drum Scale	100g/100g
Weights of each of the following: Aerosolv can puncturers Coalescing Filters Vapor transfer lines Colorimetric indicator cartridges	Pre-/Post Field Tests	On-site	Laboratory Scale	.01g/0.01g
Weights of each bulk aerosol can receptacles #1--(pre-treatment can receptacle) #2--(post-treatment can receptacle)	Each test run:before and after test run	On-site	Drum Scale	100g/100g
Field Test Measurements:				
Weight of bulk aerosol can collection receptacle #1--(pre-treatment can receptacle)	Each test run:before and after test run	On-site	Drum Scale	100g/100g
Weight of bulk aerosol can collection receptacle #2--(treated can receptacle)	Each test run: before and after test run	On-site	Drum Scale	100g/100g
Gross weight of each waste aerosol can	Each can: before and after treatment	On-site	Laboratory Balance	0.01g/0.01g
(Empty) Tare weight of each aerosol can	Each initial 75 cans of each product treated, after treatment	On-site	Laboratory Balance	0.01g/0.01g
Combined Weights: Liquid collection drum + Coalescing filter + Vapor transfer line Carbon filter drum + Colorimetric indicator cartridge	Each test run: Before and after test run	On-site	Drum Scale	100g/100g
Collected liquid composition: liquid collection drum	Each test run: when liquid collection drum reaches 35% full, 70% full, and at the end of each test run.	liquid collection drum bung hole opening	Sampling: Disposable Glass Thieves; duplicate samples - 40 ml VOA vials Analysis:HML GC/MS Scan for Volatiles	Method Specified qualitative
Gas/vapor: total hydrocarbon concentration:				

Parameter	Frequency	Location	Method	Accuracy/ Precision
Aerosolv® Unit Puncturing and Draining device	Each test run: continuous, recording at 5 second intervals	Aerosolv® Unit fixed mount	OVA: #1: Foxboro TVA 1000A w/FID	greater of 2.5 ppm or +/- 25% reading
Carbon Filter Drum exhaust	Each test run: continuous except as noted below for other periodic uses, recording at 5 second intervals	Between Carbon Filter and Saturation Indicator media	OVA #2: Foxboro TVA 1000A w/ FID	greater of 2.5 ppm or +/- 25% reading
Carbon Filter Drum inlet	Each test run: every 250 cans after carbon exhaust concentration exceeds 100 ppm (5-second time-weighted average)	Sample port at coalescing filter, prior to carbon filter	OVA #2: Foxboro TVA 1000A w/FID; (Measurements while puncturing a minimum of 3 aerosol cans and duration not less than a 1 minute)	greater of 2.5 ppm or +/- 25% reading
Potential leaks	periodic (approx. every 100 cans)	Potential leaks points	OVA #2: Foxboro TVA 1000A w/FID	greater of 2.5 ppm or +/- 25% reading
Background	periodic (approx. every 100 cans)	Downwind,	OVA #2: Foxboro TVA 1000A w/FID	greater of 2.5 ppm or +/- 25% reading
Breathing zone air contaminants	Each test run: continuous a. per H&S plan, work-shift composite sample & sequential 15 min.short term exposure samples	Operator shoulder	Sampling: Gilian LFS-113 personal air sampler Analysis: OSHA Method 07	Method specified
Occurrences of liquid releases	Each Aerosol Can Treated	On-site	Visual Observation, written documentation, photographs	n/a
Temperature	Every 2 hour during field testing	On-Site	Thermometer	2ºF
Wind speed	Every 30 minutes	On-site	Alnor Compuflow (handheld)	< 0..5 mph threshold
	Continuous	On-site	Met-One wind speed sensor (fixed) with Campbell datalogger	1 mph threshold

TEST RUN ACTIVITIES

1. Prior to the start of each test run, record the identification numbers of the following:

    a. Liquid collection drum
    b. Coalescing filter & vapor transfer flex hose assembly
    c. Carbon filter
    d. Saturation indicator cartridge

2. Prior to the start of tests on each new product class install an empty 55-gallon collection drum, carbon filter, and saturation indicator cartridge.

3. Prior to the start of each test run weigh and record the weight of the bulk storage container(s) and all aerosol cans to be used for that test run.

4. Prior to the start of each test run weigh and record the pre-treatment weights of the following components to be used in the test run:

    a. Combined weight of:
        i. Aerosolv® puncturing and draining device
        ii. Liquid collection drum
        iii. Coalescing filter & vapor transfer flex hose
    b. Combined weight of:
        i. carbon filter
        ii. saturation indicator cartridge

5. Prior to the start of each test run calibrate, record calibration results, and set up the following test equipment:

    a. Anemometer (to determine wind direction and velocity) at breathing level height and as close as practical to the Aerosolv® puncturing and draining device
    b. Thermometer located near and representative of field test operations
    c. Neotronics EXOTEX 40 Portable Multi-Gas Monitor for explosive gas monitoring
    d. Organic Vapor Analyzer (OVA) #1: detector to be mounted in a fixed position at the worst case breathing zone sampling point (initially at a height of 5 feet above the ground and a 6 inch radial distance downwind from the Aerosolv® puncturing and draining device {but no further than 24 inches away from the operator's nose and mouth}). Set the Low Level alarm to 100 ppm and High Level alarm to 4000 ppm (approx. 20% LEL); STEL alarm may be set to applicable levels at the discretion of the Industrial Health and Safety Staff.
    e. OVA #2: detector to be mounted in a fixed position between the outlet of the carbon filter outlet and the saturation indicator cartridge to determine when to initiate speciation monitoring; Set the Low Level alarm to 100 ppm to indicate time to begin speciation monitoring. Also, this detector will periodically be used to detect and monitor potential areas of source emissions or leaks, to identify peak emission locations, and to monitor carbon inlet concentrations.
    f. Synchronize all OVA clock settings and all watches to be used to record measurements and observations
    g. Record all calibration results

6. At the beginning of each test run perform the following operations:

    a. Set the data loggers ON for both OVAs to continuously record a data point every 5 seconds

7. At the beginning of each test run, periodically during the test run as noted below, and at any time conditions are observed to changed record the following information:

    a. Date and time
    b. Wind speed and direction (every 30minutes)
    c. Measure and record background FID air concentrations with OVA #2 (every 100 cans)
    d. Record temperature (every 2 hours during the test run)

8. During each test run - for each aerosol can treated:

    a. Label a sequential identification number on each aerosol can ("can number") with indelible felt marking pen (e.g., #1-1, #1-2, #1-3, etc. for test run #1)
    b. Record the aerosol can product name and product number for each can number
    c. Weigh the untreated aerosol can and record the weight to the nearest 0.01 gram
    d. Record the time that the can is placed into the Aerosolv® puncturing and draining device
    e. Puncture/drain the can using the procedures specified in the Aerosolv® Instruction Manual
    f. Record the time the aerosol can is removed from the unit.
    g. Reweigh the aerosol can to the nearest 0.01 gram
    h. discard the can into the bulk can receptacle.

9. During each test run:

    a. Record any liquid releases observed and corrective action measures taken, along with the time, and aerosol can identification number.

10. During each test run:

    a. Initiate OVA monitoring at the carbon inlet when OVA #2 reads in excess of 100 ppm (5-second time-weighted average) and every 250 cans thereafter, and when the carbon's saturation/changeout criterion has been reached.
    b. Continue OVA monitoring of Carbon Filter inlet while puncturing a minimum of 3 aerosol cans and for a minimum duration of 1 minute.
    c. Upon completion of carbon inlet monitoring, close sampling port, and return OVA#2 to monitoring the carbon filter exhaust sampling port.
    d. Resume normal can puncturing operations until another 250 can have been punctured or until the carbon filter has reached the saturation/changeout criterion.

11. During each test run

    a. Periodically (approximately every 100 cans processed) remove OVA #2 from carbon filter exhaust monitoring port and measure for background at an upwind location and for system

leaks at potential leak points.

b. Record time, number of cans processed
c. Record Background location, and measure background concentration
d. Record potential leak locations monitored and total hydrocarbon concentrations measured

12. During each test run:

    a. Collect duplicate composite liquid samples from liquid collection drum for volatiles screening analyses when liquid collection drum reaches 35% and 70% full.
    b. record time, number of cans processed
    c. collect sample through drum bung hole using disposable glass thief sampler
    d. place duplicate samples into two pre-labeled 40 ml VOA vials
    e. place VOA samples in plastic bag with custody tape and place in cooler with ice.

13. During each test run, replace the carbon filter and saturation indicating cartridge when the breakthrough criterion has been reached (i.e., when the total concentration of aerosol can gases and vapors exiting the carbon reaches 10% of the concentration entering the carbon). Weight and record the following:

    a. Combined weight of spent carbon filter and saturation indicator
    b. Combined weight of unused replacement carbon filter and indicator cartridge
    c. Combined weight of
        i. Aerosolv puncturing and draining device
        ii. liquid collection drum
        iii. Coalescer and vapor transfer line
    d. Weight of storage container and all aerosol cans treated
    e. confirm and record identification numbers of spent and replacement carbon filters and indicating cartridges

14. During each test run, replace the liquid collection drum when the liquid level reaches 70% capacity:

    a. Reweigh and record the combined weights of:
        i. Aerosolv puncturing and draining device
        ii. full liquid collection drum
        iii. coalescer and vapor transfer flex hose
    b. Weigh and record the combined weights of:
        i. Aerosolv puncturing and draining device
        ii. replacement liquid collection drum
        iii. coalescer and vapor transfer flex hose
    c. Weigh and record the combined weight of storage container and all aerosol cans treated

15. At the end of a selected test run for each of the three sets of test runs:
    a. Randomly select 75 treated waste aerosol cans from those treated during the test run
    b. Measure the tare weight of the selected cans in accordance with ENVIRDEPT SOP #:931-98-009.

16. At the end of each test run, reweigh and record the following:

    a. Combined weight of:
        i. Aerosolv puncturing and draining device
        ii. liquid collection drum
        iii. coalescer and vapor transfer flex hose
    b. Combined weight of:
        i. carbon filter
        ii. saturation indicator cartridge
    c. Weight of bulk storage container and all aerosol cans treated

17. At the end of each test run, collect duplicate composite liquid samples from the liquid collection drum for volatiles screening analyses by HML.

    a. At the end of each test run
    b. each time the carbon filter requires changeout

18. At the end of each test run, measure and record:

    a. time
    b. temperature
    c. wind speed and direction

19. At the end of each day's operations:

    a. check the calibration and record the results for:

        i. laboratory balance
        ii. OVAs #1 and #2 (FID)
        iii. explosive gas monitor
    b. measure and record:
        i. time
        ii. temperature
        iii. wind speed and direction

20. Upon completion of all test runs, weigh and record the individual weights of the following components of the Aerosolv technology which were used during the tests:

    a. Aerosolv puncturing and draining devices
    b. Coalescing filter and vapor transfer flex hose assemblies

TESTING PERSONNEL

Minimum of three personnel will be required to conduct test runs:

- One industrial hygienist to oversee operations of the monitoring equipment and to record observations
- One technician to perform the weighing and marking of the cans
- One operator for the Aerosolv® unit.

Oversight: DTSC representative(s) will be present on-site to oversee three or more of the identified test runs field tests. DTSC will determine the level of oversight required depending on how the test runs proceeds and problems encountered.

FACTORS AFFECTING PERFORMANCE

Factors affecting performance include:

Fullness of the Waste Aerosol Can to Be Treated.

Type of Aerosol Can Product to Be Treated

Headspace Remaining in the Collection Drum (I.e. Liquid Level in Collection Drum)

Elapsed Time and/or the Cycles of Operation since Last Maintenance

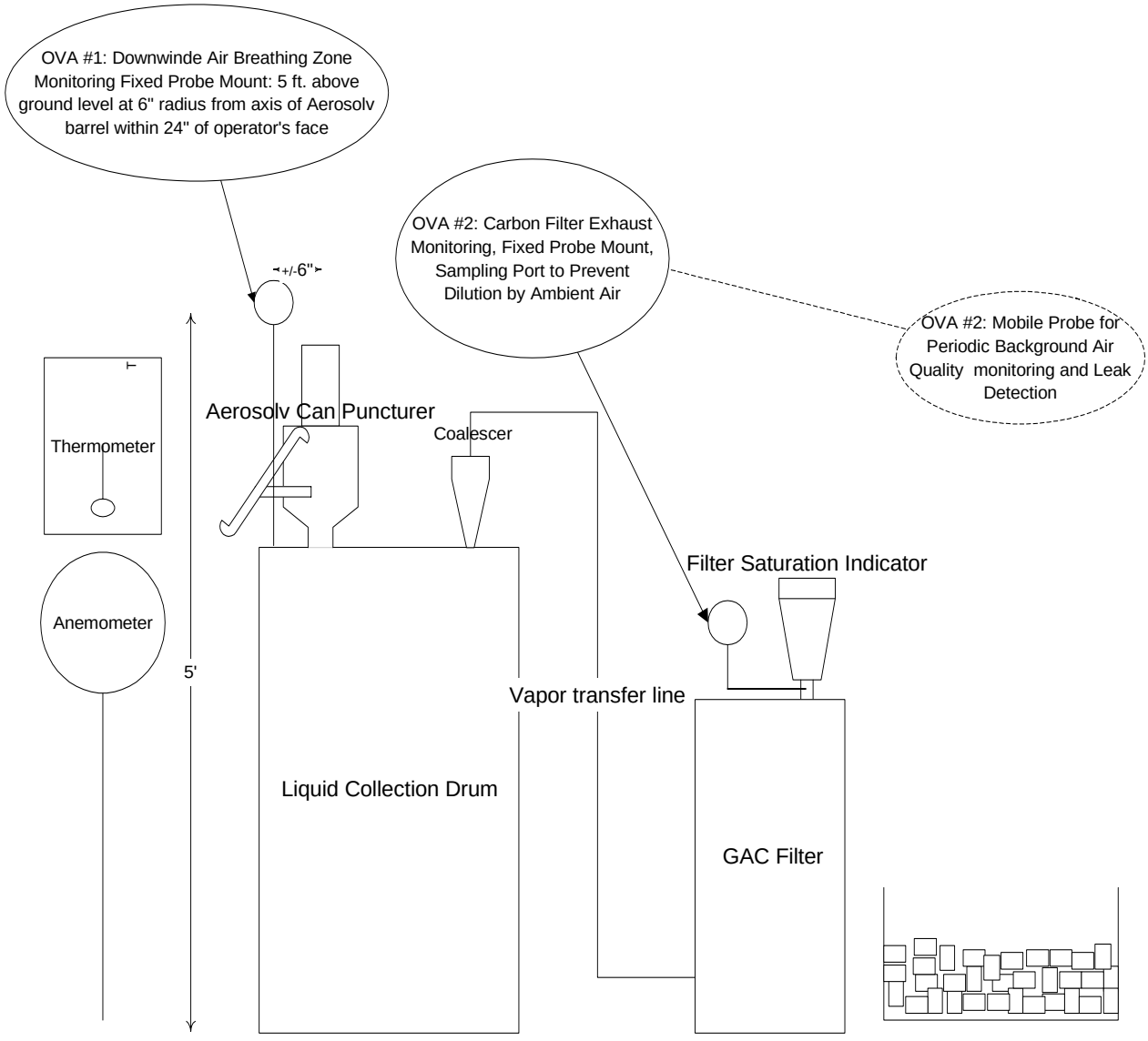
Carbon Filter Capacity Remaining.

Operator Variability

APPENDIX A - Test Layout and Sampling Points

Figure 1 is a schematic of the Katec Aerosolv® system. Potential release points include the seals around the puncture pin, the seat for the inverted aerosol can, the check valve at the drum bung, the equipment connections (drum to coalescer, coalescer to flexible vapor line, vapor line to filter, and filter to saturation indicator cartridge), as well as the exit port on the indicating cartridge.

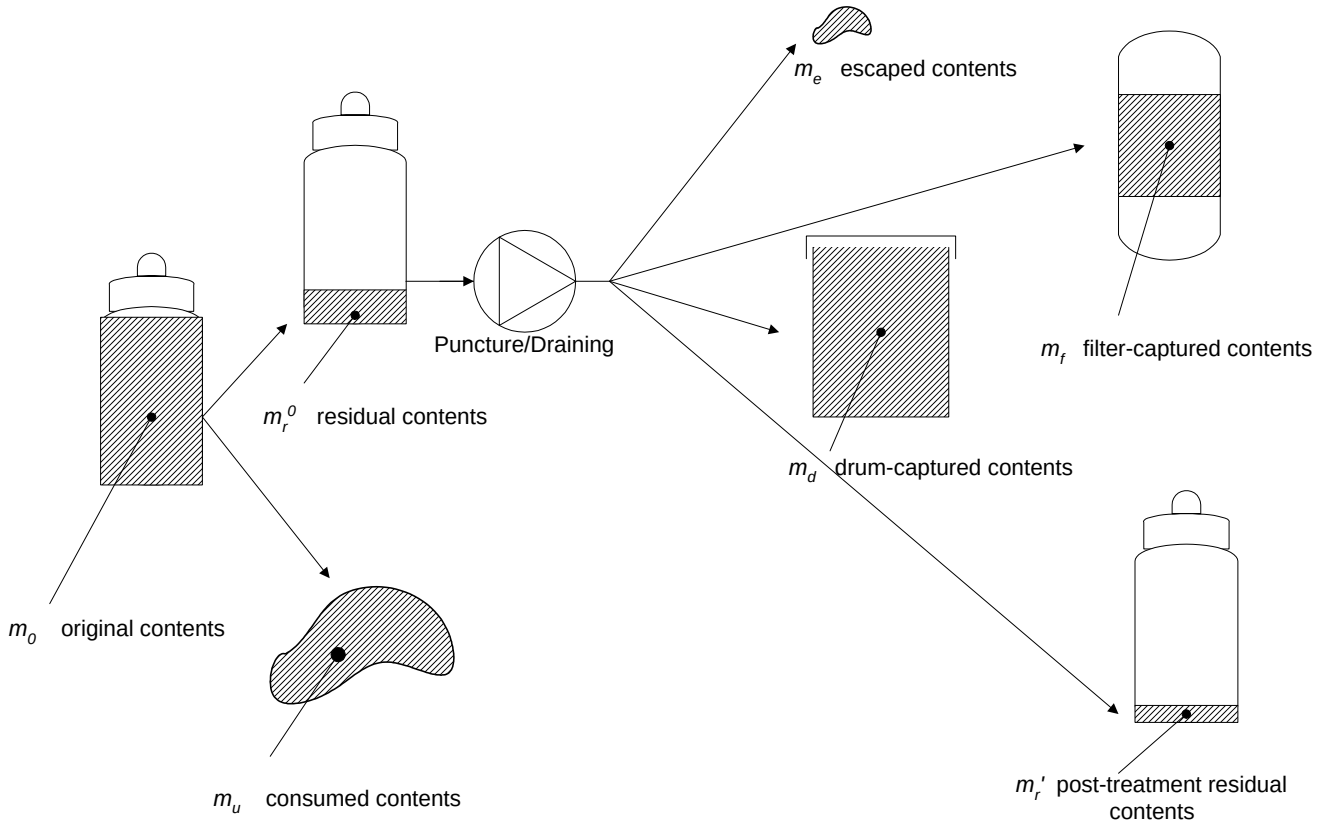
Figure 1



Katec Aerosolv Treatment System

APPENDIX B - Mass Balance For Aerosol Can Puncturing & Draining

The figure below depicts the fate of the contents of aerosol cans from initial use by the consumer to after treatment by the Aerosolv® puncturing and draining system. The consumer uses or discharges through the spray nozzle a portion of the original can contents, m_o, leaving a residual behind in the can, m_r, (the untreated waste aerosol can contents). Upon puncture and draining, a portion of this residual is collected in the drum (m_d) or captured onto the filter media (m_f). The portion of m_r which is not collected or captured escapes as fugitive emissions or liquid releases (m_e), or is the residual remaining in the treated aerosol can which was not effectively removed (m_r').



Aerosol Can Treatment Mass Balance

$$\textit{Capture efficiency (objective 2b)}: \quad \frac{m_d + m_f}{m_r^0 - m_r'} \times 100\,\% \;\rangle\; 90\,\%$$

$$3\%\ \textit{criterion (objective 1a)}: \quad \frac{m_r'}{m_0} \times 100\,\% \langle\ 3\%$$

$$\%\ \textit{removal efficiency (objective 1b)}: \frac{m_r^0 - m_r'}{m_r^0} \times 100\,\%$$

APPENDIX C - List of Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ALARA	as low as reasonably achievable
APCD	Air Pollution Control District
APF	Assigned Protection Factor
APR	Air Purifying Respirator
ASTM	American Society for Testing and Materials
CAL OSHA	California Code of Regulations; Titles 8, 22 and 26
CCR	California Code of Regulations
CGI	Combustible Gas Indicator
DTSC	California Department of Toxic Substances Control
FID	Flame Ionization Detector
GCMS	Gas Chromatograph Mass Spectrometer
HML	DTSC Hazardous Material Laboratory
IDLH	Immediately Dangerous to Life and Health
LEL	Lower Explosive Limit
MSDS	Material Data Safety Sheet
OVA	Organic Vapor Analyzer
OSHA	Occupational Safety and Health Act
PEL	Permissible Exposure Limit
PID	Photoionization Detector
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
QA/QC	Quality Control/Quality Assurance
REL	NIOSH Recommended Exposure Limit
SOPs	Standard Operating Procedures
STEL	Short-term Exposure Limit
TWA	Time-weighted Average
UEL	Upper Explosive Limit
VOA	Volatile Organic Analysis